

Temporary prosthetic fitting for below-knee amputation

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Abstract

The problems encountered in fitting and using the permanent below-knee prosthesis in developing countries are the high price of the prosthesis, inadequate fitting and lack of proper rehabilitation. In Turkey, the preferred treatment of the stump post-operatively is by the soft dressing method with bandaging for maturation and shrinkage. Generally, the application of the permanent prosthesis is in the sixth month post-operatively.

Since in patellar-tendon-bearing (PTB) sockets, stumps have to withstand high pressures in limited areas, the PTB socket can only tolerate small volume changes in the stump. For this reason bandaging over a long period may be insufficient for adequate stump shrinkage and amputees will need another below-knee prosthesis, which most of them cannot afford after only a few weeks use.

In the authors' clinic, 19 amputees were fitted with simple, effective and inexpensive temporary prostheses following either conventional immediate post-operative dressing or the soft dressing method. The temporary prosthesis is worn for two months. It produces fast stump shrinkage, helps maturation and permits ambulatory discharge even in bilateral amputees. For economical reasons, only eight of nineteen patients were fitted with permanent prostheses, all wearing them successfully without the necessity of further rehabilitation.

Introduction

The major goals of lower extremity amputation are to obtain a well-healed stump and permit mobilization of the patient with a properly fitted permanent prosthesis. Immediate

post-operative rigid dressing and pylon fitting provide good primary wound healing, facilitate stump shrinkage and prevent formation of oedema and contractures of the knee, while allowing early mobilization of the patient (Sarmiento et al., 1970; Vitali et al., 1978).

The concept of rigid dressing was first advocated by Muirhead Little during the First World War; it was re-introduced by Berlemont in 1961 and greatly stimulated by Weiss in 1963 (Lien et al., 1973; Kerstein, 1974; Kerstein and Dugdale, 1975; Vitali et al., 1978).

However, conventional immediate rigid dressing also has some disadvantages (Wu et al., 1979). It requires experienced technicians and as the oedema subsides the dressing has to be changed many times before the application of the permanent prosthesis. Since it immobilizes the knee, it also prevents the rehabilitation of the knee joint. It does not permit observation of the stump and wound.

The other method of rehabilitation with elastic stump bandaging may postpone the fitting of the permanent prosthesis by at least six months (Laforest and Regon, 1973; Baker et al., 1977; Manella, 1981).

The wearing of a temporary prosthesis is beneficial in obtaining proper stump maturation (Laforest and Regon, 1973; Kerstein and Dugdale, 1975). It facilitates the management of the permanent prosthesis and avoids the alternative of the fitting of a second permanent prosthesis. Consequently it is suggested that in developing countries, simple, inexpensive temporary prostheses are essential.

The authors' apply removable rigid dressing technique with a simple dynamic alignment unit and a SACH foot for two months following wound healing which takes place either with immediate post-operative conventional rigid dressing or soft dressing (Sarmiento et al., 1970; Lien et al., 1973).

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Rigid dressing prevents the formation of oedema and extremity contractures efficiently. It facilitates stump maturation, maintenance of postural reflex, and permits more simplified rehabilitation with good psychological effects (Kerstein and Dugdale 1974; Wu et al., 1979).

Materials and method

In the Department of Orthopaedic Surgery and Traumatology in Ege University, between 1984-1988, 19 patients with below-knee amputation have been managed with the procedure of removable rigid dressing and temporary prosthesis. The etiology for amputations was vascular in seven patients and trauma in 12 patients. Average age of the patients was 44 (max. 65, min. 20). Sixteen were male and three were female.

If the patients were suitable, a rigid dressing and pylon with dynamic alignment unit were applied immediately after the operation. In nine patients, two weeks following surgery the stitches were removed and the temporary prosthesis applied. For the rest of the patients, temporary prostheses were applied following soft dressing. A plaster PTB socket was applied with dynamic unit and SACH foot. For socket



Fig. 1. Felt pads placed on the pressure sensitive areas.

preparation, a stockinette was applied to the healed stump or on a sterile dressing, if the wound was not completely healed. Three felt pads were applied to protect the sensitive pressure areas (Fig. 1). A normal plaster cast was applied over the stump. The cast trim line was supra-patellar level anteriorly and patellar-tendon level posteriorly to allow 90 degrees of comfortable knee flexion (Wu et al., 1979). Before the cast dried, pressure was applied over the patellar-tendon with both thumbs and the popliteal area with fingers of both hands. The upper part of the simple dynamic alignment unit was fixed to the socket with a plaster cast. To provide easy adaptation of the stump to the socket in the initial days, a hole 2 cm diameter was made in the bottom of the socket. If the stump was comfortable, the socket was removed for fixing of the pylon and application of the elastic bandaging. The straps were attached to the socket with plaster and incorporated to the waist belt through a supracondylar band (Fig. 2).

On the first day the patient was permitted to exercise in the parallel bars for a short time only. On the second day if the patient tolerated the stresses and the stump condition was good, the weightbearing period was increased depending on the comfort of the patient. If the patient complained of pain in the stump end or piston action of the stump, it was checked by inspection through the end-hole. The temporary prosthesis was removed every evening and as the stump shrunk more stockinettes were added. If the stump had shrunk very rapidly in a few days the cast socket was changed.

Results

During the four years of the study, 19 patients with 20 stumps were fitted with a temporary cast socket prosthesis. Post-operatively nine patients managed conventional immediate rigid dressing with dynamic alignment unit, pylon and SACH foot prior to the temporary prosthesis. Ten patients were treated with soft dressing and temporary prosthesis as soon as wound healing had been controlled.

Eight patients were finally fitted with permanent prostheses. One patient was fitted with a permanent prosthesis after wearing the temporary prosthesis for one month, but developed severe stump shrinkage for which

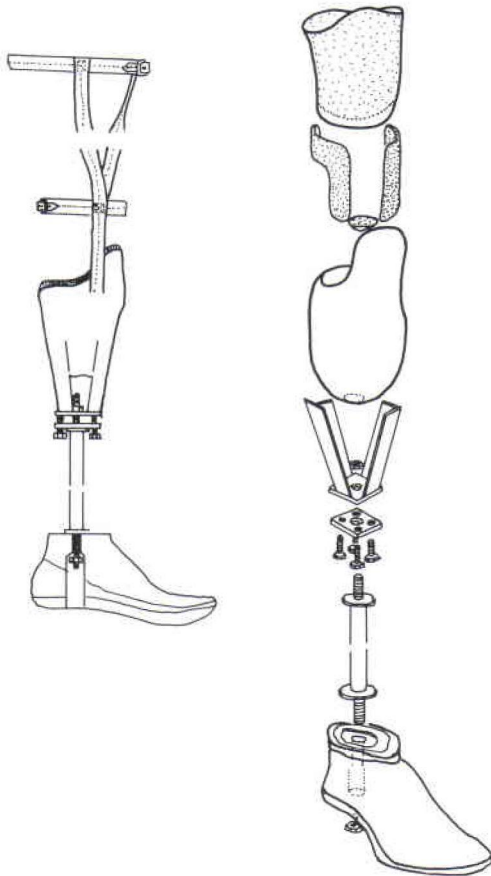


Fig. 2. Temporary PTB prosthesis with SACH foot, simple dynamic alignment unit and cast socket.

even the addition of six socks was insufficient thus necessitating the provision of a new permanent prosthesis. Two patients were still using their temporary prosthesis six months after the operation.

Three patients removed their prostheses for the weekend and applied elastic bandage but were not able to re-apply their prostheses, because of oedema of the stump. New plaster sockets were then made for these patients and one week later, oedema had subsided and they were able to put on their old sockets again. The reason may be either misuse of bandages or the ineffectiveness of bandage compared to "socket pumping" action in the rigid dressing (Manella, 1981).

The average period of time for rehabilitation from amputation to final ambulatory discharge using the temporary prosthesis was 62 days (max. 133, min. 21). All the wounds were

already healed at the time of discharge. The permanent prosthesis was ordered after the temporary prosthesis had been worn for two months. By this time, most of the patients were wearing eight or nine stump socks.

Discussion

The primary purpose of amputation is the treatment of the disease of the patient. Especially for the below-knee level it is hoped that a high degree of restoration of function will be achieved particularly with the use of the PTB prosthesis (Kerstein and Dugdale, 1974).

The rate of success decreased rapidly with inadequate control of shrinkage of the stump and poor rehabilitation with an improperly fitted permanent prosthesis (Rajeswaramma et al., 1973). To estimate the benefits which might be attained using a temporary prosthesis 68 patients with below-knee amputations performed between 1977-1981 in the authors' clinic were reviewed retrospectively and it was found that only one patient was able to walk with a prosthesis. The major problem was the provision of a well-fitted prosthesis, mainly because of socket problems and the expense of components.

Ready-made temporary prostheses can also be used in the initial stages of rehabilitation (Kerstein, Dugdale, 1974), but these are also quite expensive and may produce stump problems because they do not have custom-made sockets.

These points are very important for the developing countries since most people can afford only one prosthesis. In the method described here a "removable cast socket temporary prosthesis" is used after conventional post-operative rigid dressing or soft dressing and prior to the provision of a permanent prosthesis. All the components except the SACH foot are hand made with ordinary tools and machinery. The dynamic alignment unit used provides full rotation, thirty degrees of angulation and 1½ cm of length adjustment. The same SACH foot is used in the permanent prosthesis. All patients are mobilized with the temporary prosthesis including one bilateral amputee. Standing position is stable as for other well-fitted below-knee amputees (Vittas, 1986) (Fig. 3).

If the stump is long (3 cases) the end-hole helps to place the stump into the socket and



Fig. 3. Weightbearing training.

also gives the opportunity to examine the stump end during weightbearing.

Reduction of oedema occurs on the first or second days of wearing the prosthesis. Stump shrinkage was so rapid in three patients that new plaster sockets had to be made.

At the beginning all patients had the fear of breakdown of the wound or sutures, but weightbearing was not a problem for most patients. Only in three geriatric patients could the wound not stand weightbearing. In one of these three patients who had Buerger's disease an above-knee amputation was performed. The other two patients were diabetic and their unhealed wounds presented a minor problem and healed after the wearing of the prosthesis was delayed for one week. On stump shrinkage, a sufficient number of socks was added until eight or ten ply. Stump socks are not readily available and are expensive (Wu et al., 1979), so end sutured stockinettes have been used. A nylon sock is preferred for the last ply for ease of fitting.

Psychologically all patients accepted the temporary prosthesis. No serious objection was encountered against the prosthesis. Balance

patterns were satisfactory in all patients in accordance with their age.

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